K. V. Krombein

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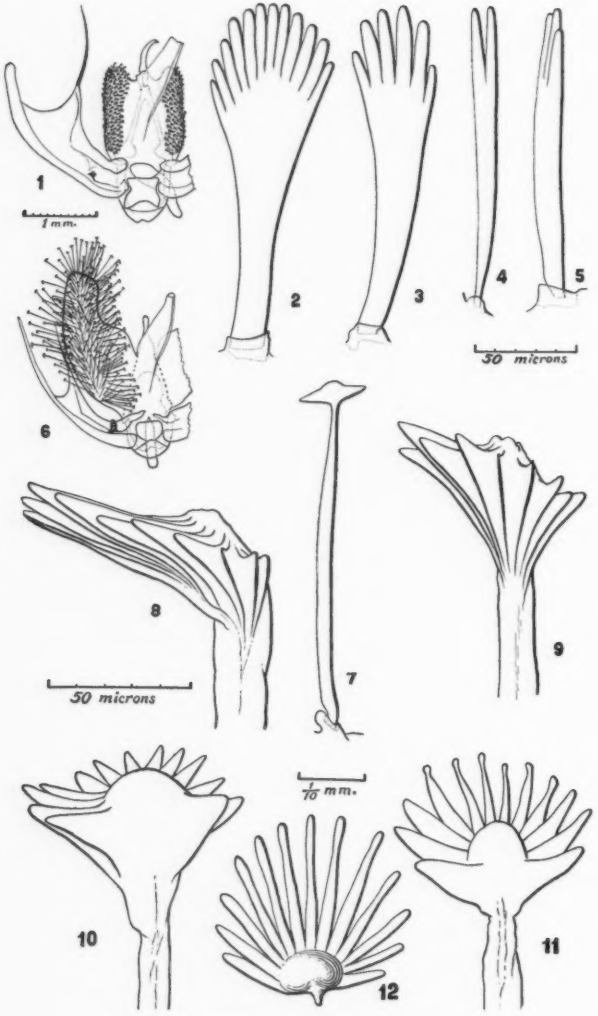

SETAE OF MALE GENITALIA OF AMYNA—RICHARDS.

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The Remarkable Setae on the Male Genitalia of the North American Species of the Genus Amyna. (Lepidoptera: Noctuidae).

By A. GLENN RICHARDS, Jr., Biology Department, College of the City of New York.

(Plate I.)

The modified setae with which this paper is largely concerned are confined to the lateral lobes of the tegumen.[1] These lobes (figs. 1 and 6) arise from the entire lateral surface of the tegumen (ninth abdominal tergite) and extend from the base of the uncus (tenth abdominal tergite) to the ventral edge of the tegumen at the point of its articulation with the vinculum (coxosternal arc of ninth abdominal segment) and its appendage, the harpe. In *Amyna octo* they are relatively narrow (fig. 1) but in *A. bullula* they are greatly developed processes and appreciably larger than the harpes (fig. 6).[2]

The setae on the lateral lobes of the tegumen of *Amyna octo* are about 160-180 in number on each side but are so crowded and overlapping that a more accurate counting cannot be made readily. In shape they vary from nearly simple, albeit somewhat swollen and distally flattened forms (not illustrated), through apically bifurcated forms (fig. 4) to ones with numerous finger-like processes up to fourteen in number (figs. 2 and 3). In size these fimbriated setae vary in length from about 140-160mu from the setal socket to the distal end of the longest fimbriae; in breadth they vary from about 3-16mu at the socket to from about 7-60mu at the broadest point near the apex, the breadth being correlated with the number of fimbriae on the seta. The individual fimbriae vary considerably, being from about 3-8mu broad at the broadest point and about 15-40

[1] Many normal simple setae, long or short, are found on the harpes, especially on the apical part of sacculus, and on the uncus.

[2] A formal description of the general structure of the male genitalia is given near the end of this paper.

mu long. These fimbriated setae have the processes all in a single row (plane) across the apical end of the distally flattened seta (fig. 5) On the whole these forms are found scattered about on the lobes of the tegumen but there is a noticeable tendency for the ones with the fewer prongs to occur along the outer margin and the many-pronged ones to occur away from the margin.[3]

The setae on the lateral lobes of the tegumen of *Amyna bullula* can be counted with considerable accuracy due to the greater area concerned and to the distinctive apical modifications (except that a few setae are broken off from all mounts). The number present on each of four lobes (both sides of two specimens) varies from about 185 to 200—only slightly more than on the smaller lobes of *A. octo*. In size they are rather constant. They average slightly more than one-half a millimeter in overall length, about 14mu in breadth at the base, about 22mu in breadth at the greatest diameter at the center of the 'stalk', and then seem to contract to about 8mu just before the apical structure.[4] The apical structure has a maximum width of about 90mu across the longest flanges; the apical dome is about 20-30mu broad and 7-9mu high[4]; the flanges are in a graded series of lengths varying from about 15-50mu. In shape these setae seem to be fairly constant. They appear in profile as distinctly mushroom-shaped when viewed from 'front or rear' (fig. 7), or with varying degrees of asymmetry when viewed from the side or some other angle (figs. 8 and 9). These setae are made up of a long swollen basal stalk which seems to decrease in diameter distally[4], and which is crowned with an elaborate apical structure (figs. 7-12). This apical structure is composed of a central dome-like area of rather thin chitin which is usually quite rounded but sometimes somewhat

[3] Compare Pierce, 1914, figure of setae on ovipositor of female of *Theria rupicapraria*, and Ferris, 1934, fig. 2N (seta from coccid).

[4] The chitinous walls of the setae are more or less delicate in this area and frequently have a wrinkled appearance which may possibly indicate shrinkage or partial collapse either in drying or during the process of preparing the macerated mount from the dried specimens. The tendency of some flanges to appear thicker at their tips, and the variation and tendency towards ribbing of the apical dome may also possibly be due to such shrinkage.

wrinkled or angulate[4], and from which there radiate out on three sides from 12-14 triangular blunt-tipped flanges (figs. 8-12). Viewed 'from the side', the tip of one of these remarkable setae appears as a dome with long triangular flanges extending to one side and shorter flanges extending towards the observer (fig. 8). Viewed from more or less 'in front or rear' the setae seem to have varying degrees of asymmetry depending on the angle from which they are viewed (fig. 9). Viewed from a right angle to what I have called the 'side view' the setae may appear to be perfectly symmetrical (figs. 10-12). In other words, they are bilaterally symmetrical but not radially symmetrical. No perfect view straight down onto the tip of one of these setae was obtained but figure 12 approaches such rather closely and shows the relative lengths of the flanges more accurately than any of the other figures.

One naturally wonders what function these strange setae of *Amyna bullula* may have. Being a part of the male genital armature it is not unreasonable to assume some connection with copulation. They do not have the general external characteristics of scent-producing or scent-carrying setae (see papers by Eltringham and Snodgrass), and being so extravagant in structure one would like to think them more than mere tactile receptors. But with no knowledge of the nature of the cytoplasmic contents of the setae and no knowledge of the type of innervation it would be unwise to guess. Unfortunately, aside from its rarity, *Amyna bullula* is a rather small moth and the lobes bearing these setae are normally retracted into the end of the abdomen except during the act of copulation. It would seem no simple matter to study the function of these setae even if ample living material were available.

Only two species of the genus *Amyna* Guenée are found in North America north of Mexico[5]. *A. octo* Guenée is of almost

[5] The genus *Amyna* Guenée is listed at present in the subfamily Erastriinae (Acontiinae), following Hampson (1910), but would seem better placed in the subfamily Acronyctinae (Apatelinae) despite the moderately well developed vein M_2 in the hind wing — or at least the two North American species seem acronyctine. I have already pointed out elsewhere that the North American species of *Amyna* have an unique development in the thoracic tympanum, and in that paper suggested that the genus might better be considered as an acronyctine (Richards, 1933).

cosmopolitan distribution. It is fairly common in the southern states and extends northward along the Atlantic coast to New Jersey. *A. bullula* Grote is a rare species recorded from Georgia to Texas and southward into Central America. The specimens of both species used in this study were collected by the author at light at Athens, Georgia, August to October, 1926-1929.

The male genitalia of *Amyna octo* and *bullula* (figs. 1 and 6) are symmetrical; uncus of moderate length, pointed and bearing a few simple setae; anal tube rather long and with a weak narrow subscaphium; tegumen with highly developed lobes[6] arising from the entire lateral margin and bearing specially modified setae (see above); vinculum narrow and rounded or slightly excavated at tip; juxta large; transtillae short and broad; harpes conspicuously divided into two parts: 1) a long sacculus which projects beyond the rest of the appendage and which is clothed, especially near the tip, with many long simple setae, and 2) an anterior margin (cucullus) terminating in a long simple seta; these two sclerotized parts of the harpe are connected by a rather broad area of membrane, near the basal part of which is located the small clasper; aedoeagus with spined vesica.

I have slides of the genitalia of representative species of the majority of the North American genera of Noctuidae, and so

Incidentally, certain North American species, placed in the Erastriinae by Hampson (1910), have already been moved to the Acronyctinae. His "*Amyna teratophora* H.-S.", "*Bryocodia lepidula* Grt.", and "*Bryocodia avirida* Sm." have all been placed in the acronyctine genus *Agriopodes* Hampson by Barnes and McDunnough (1917). I feel inclined to suggest for *Amyna octo* Guenée and *A. bullula* Grote a position somewhere in the neighborhood of *Cerma* Hübner or *Agriopodes* Hampson, although I realize the uncertainty of much of the generic grouping in the Acronyctinae and even of the separation of what I have called the Erastriini (Richards, 1933).

[6] These lobes are probably to be considered the peniculus of Pierce (1909), although in no other genus known to the present author do they arise from the *entire* lateral margin of the tegumen. Usually the peniculus arises from the ventral portion of the tegumen but in some noctuids (e. g. *Enargia decolor* Walker) a lobe, perhaps to be called a peniculus although it does not bear a dense tuft of setae, arises from the dorsal part of the tegumen. The situation is further complicated by the uncertainty as to the homology of the peniculus (a term used principally in the Noctuidae) with the outgrowths of the tegumen in other Lepidoptera, namely the socius and gnathos.

far as I know no other genus of American Noctuidae possesses such highly modified setae, either of these or of any other type. Certain groups do have heavy vestiture on moderate enlargements of the tegumen (peniculus of Pierce, 1909) but this vestiture in all other species of Noctuidae known to me and in all the species figured by Pierce (1909) consists of many long simple setae. 'Hair pencils' are frequently found on various parts of the body of Lepidoptera but the setae in such tufts are of relatively simple structure (see Eltringham, 1915-1933). Distally spatulate setae (clavate scales of Pierce, 1914) are found on various parts of the male genitalia of a number of species of Lepidoptera (Pierce, 1914; Richards 1936). Setae similar to those described herein for *Amyna octo* are found on certain coccids (Ferris, 1934) and on the ovipositor of the female of the geometrid moth *Theria rupicapraria* (Pierce, 1914). Nowhere have I seen reference to setae resembling the type found on the male genitalia of *Amyna bullula.*

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EXPLANATION OF PLATE I.

All drawings made by the author with a compound microscope and with the aid of a camera lucida. Dimensions indicated by scales drawn from a stage micrometer with the aid of a camera lucida and with the same lenses that were used in making the drawings.

Fig. 1. Small scale drawing of the male genitalia of *Amyna octo* Guenée showing the lateral lobes of the tegumen and the position of the modified setae thereon. Harpe omitted from one side.

Figs. 2-5. Enlarged drawings of single setae from the lateral lobes of the tegumen of *A. octo*. Figure 5 is a drawing of a view at almost a right angle from the views shown in figures 2-4. All four drawings at same magnification (scale drawn below figs. 4-5).

Fig. 6. Small scale drawing of the male genitalia of *Amyna bullula* Grote showing the lateral lobe of the tegumen and the position of the modified setae thereon. Setae not sketched individually with the camera lucida and so only approximately correct both as to number and position. Harpe and lobe of tegumen omitted from one side. Drawn at same magnification as figure 1.

Fig. 7. Enlarged outline drawing of a single seta from the lateral lobe of the tegumen of *A. bullula*. Scale of magnification drawn below.

Fig. 8. Greatly enlarged drawing of 'side view' of the apical structure of a setae from the lobe of the tegumen of *A. bullula*. Scale of magnification drawn below.

Fig. 9. Greatly enlarged drawing of a diagonal view of the apical structure of another seta from the lobe of the tegumen of *A. bullula*. Magnification same as figure 8.

Fig. 10. Same, but looking slightly down on the apical structure and from the 'rear side'. Magnification same as figure 8.

Fig. 11. Same, but looking down on the apical structure from a greater angle.

Fig. 12. Same, but looking almost directly down on the apical structure.

Where and When to find the Orthoptera of Pennsylvania, With Notes on the Species Which In Distribution Reach Nearest This State.

By MORGAN HEBARD, Philadelphia, Pennsylvania.

(Continued from page 39.)

CONOCEPHALUS NIGROPLEURUM (Bruner). May be present locally throughout the northwest portion of the State, but is known only from Milton, Pennsylvania, a southeastern limit. Ithaca, New York is a northeastern limit. Inhabits grasses and sedges in humid spots. Appears adult in early July.

C. ATTENUATUS (Scudder). A central western species probably present locally throughout Pennsylvania excepting all high areas in the mountains and the northeastern portion of the State. Eastern limits are Ithaca, New York; Sussex and Rancocas, New Jersey, and New Castle, Delaware. I have material from Cornwells and Harrisburg, Pennsylvania. Local but abundant when found in tall vegetation near water. Appears adult in early August.

C. SALTANS (Scudder). Should be present locally throughout the lowlands of all but northern Pennsylvania. Yet known only from Fern Hill in Chester County. Found in grasses on dry poor soil or sandy areas. Appears adult in early August.

DECTICINAE.

ATLANTICUS TESTACEUS (Scudder). Present but very local, occasionally probably moderately numerous, throughout Pennsylvania. In dead leaves and undergrowth of scattered deciduous forests, particularly of oak. Appears adult in early June.

A. DAVISI Rehn and Hebard. Present throughout the mountains of Pennsylvania. Local but often numerous. In similar environment. Appears adult in early June.

A. AMERICANUS AMERICANUS (Saussure). A more austral species than the preceding, probably very locally distributed in the eastern lowlands and eastern mountains of Pennsylvania and has as yet been taken only at Pink Hill in Delaware County in open woods on a serpentine outcrop. Appears adult early in July.

GRYLLACRIDIDAE.

GRYLLACRINAE.

CAMPTONOTUS CAROLINENSIS (Gerstaecker). Probably confined to the lowlands of southeastern Pennsylvania, a specimen from Dresher constituting a northern limit. Local and very seldom seen in shrubbery and vine tangles. A comparatively rare nocturnal insect. Appears adult early in August.

RHAPHIDOPHORINAE.

The introduced *Tachycines asynamorus* Adelung will probably be found in greenhouses and cellars in Pennsylvania, as it is now widely distributed and established in such artificial environment in the United States.

HADENOECUS PUTEANUS Scudder. Generally distributed in the South Mountain hills and the mountains of Pennsylvania as far north as Allentown and Center County (material before me) and east and south to Allentown, near Reading (material before me) and Rockville. Widespread southward through the Appalachian Mountains. Lives in rock piles, holes in the ground, wells and caves. Appears adult in mid-July.

CEUTHOPHILUS BREVIPES Scudder. A widespread and common boreal species present through all of Pennsylvania except the eastern lowlands. Spruce Cabin Falls and Blue Ridge Summit are southeastern limits. Six records from the State. Adults are present in the Spring, but majority here taken in August.

C. GRACILIPES GRACILIPES (Haldeman). An Appalachian species occuring throughout the forests and caves of the mountains of Pennsylvania and absent from the eastern and northwestern lowlands. Very common. Eleven records from State. Lehigh Gap and Blue Ridge Summit are southeastern limits. Adults appear late in May, many here taken in August.

C. MERIDIONALIS Scudder. A relatively scarcer mid-western species known in the East only from eight localities in the lowlands of the eastern portion of Pennsylvania, northern limits being Dark Hollow, Lebanon and Harrisburg. Prefers low moist forests. Adults appear early in Summer and are most numerous in the Fall.

C. PALLIDIPES E. M. Walker. A common boreal and Appalachian species, probably occurring throughout Pennsylvania. Prefers mixed and deciduous forests. Fifteen records for the State with Whitemarsh a southeastern limit. Adults appear early in Summer and are most numerous in the Fall.

C. LATENS Scudder. A moderately common species present throughout the decidous forests of southern Pennsylvania except at high elevations and occurring up the Susquehanna River to Orangeville. Six records from State. Adults appear in early June, are more numerous in the Summer and some survive to late Fall.

C. MACULATUS (Harris). A relatively scarcer boreal species possibly present in all but southwestern Pennsylvania. Material is before me from Hess Cave near Reading. Previously doubtfully recorded only from Chestnut Hill and Rockville. Present adult through the year, the majority in July and August.

C. UHLERI Scudder. An exceedingly common south-central and Appalachian species, present only in southeastern Pennsylvania, northwestern limits being Lehigh Gap and Rockville. Known from nine localities, the majority about Philadelphia. Appears adult in June but the majority present in late Fall.

C. LAPIDICOLA (Burmeister). A south Appalachian woodland species present in the lowlands of southeastern Pennsylvania north to Monocacy, Lebanon and Dauphin. Relatively scarce but was found at Whitemarsh in very great numbers. Twelve localities for State. Present adult throughout the year, the majority from June to August.

C. DIVERGENS Scudder. Known from southeastern Pennsylvania this common species probably also occurs at low elevations in the intervening territory. Very generally distributed but particularly fond of forests in mesic environment. Eight records for the State. Appears adult in early June, the majority in July and August.

C. NIGRICANS Scudder. All of Pennsylvania included in its distribution but not yet recorded from the northwestern section. A moderately common insect generally present in forests. Nineteen records from the State. Adults present throughout the year, majority probably from June to December.

GRYLLIDAE.

GRYLLINAE.

GRYLLULUS ASSIMILIS (Fabricius). Present throughout Pennsylvania and often very abundant particularly in grassland. Broods appear adult the middle of May, in the Summer and in the Fall.

G. DOMESTICUS (Linnaeus). Introduced and now established. Material before me from Philadelphia, West Philadelphia and Upper Darby. Rarely seen but sometimes very numerous when found. Possibly adult throughout the year.

MIOGRYLLUS VERTICALIS (Serville). Probably present through southern Pennsylvania but very local and not abundant. Lives in fields and moist spots in burrows, under the grasses, boards, etc., and so is comparatively rarely seen. Probably feeds at night more than during the day. Appears adult in late May. I have material from Philadelphia, Villanova and near Lancaster.

NEMOBIINAE.

NEMOBIUS FASCIATUS FASCIATUS (DeGeer). Everywhere except in heavy forests in Pennsylvania. Extremely abundant. Appears adult in early July.

N. FASCIATUS TINNULUS Fulton. Local, usually in large colonies in forest undergrowth. I have material from North as far as Stroudsburg and Diamond Valley in Huntingdon County. Represents rather an environmental development than the usual concept of a race. Appears adult in early August.

N. MACULATUS Blatchley. Local but usually in large colonies in forest undergrowth. Probably absent from boreal portions of Pennsylvania and as yet known only from Cornwells, Chestnut Hill and Camphill in Dauphin County. Appears adult in early August.

N. CUBENSIS PALUSTRIS Blatchley. Should be found in sphagnum bogs very locally in Pennsylvania, but is only represented by material from Tinicum Island, Villanova and Stroudsburg. Usually numerous when found but both difficult to locate and to capture. Appears adult in mid-August.

N. BRUNERI Hebard. Confined to extreme southeastern

Pennsylvania where at Cornwells one large colony was located among dead leaves on the sandy shore of the Delaware River. Cornwells is a northeastern limit. Appears adult in early August.

N. CAROLINUS CAROLINUS Scudder. Probably throughout Pennsylvania in dead leaves and undergrowth along fence rows and woodlands and also in open woods. Appears adult early in July.

OECANTHINAE.

OECANTHUS EXCLAMATIONIS Davis. Probably throughout Pennsylvania except in the most boreal areas. Rarely seen and apparently more definitely arboreal than any of the other species of the genus. Prefers oaks, maples and other deciduous trees. Can be considered one of the scarcer crickets. Appears adult in late July.

OE. ANGUSTIPENNIS Fitch. Probably generally distributed through Pennsylvania but may be absent from the more boreal portions. Prefers shrubbery and is often present locally in very large colonies. Appears adult in mid-August, greatest abundance in late Fall.

OE. NIVEUS (DeGeer). Much the same distribution but usually decidedly less abundant and often found singly. Prefers vines, apple trees and bushes. Appears adult in mid-July.

OE. NIGRICORNIS QUADRIPUNCTATUS Beutenmuller. Very abundant and generally distributed in weeds in open throughout Pennsylvania. Rather an adaptation to certain types of vegetation; limited to a definite area of distribution which however is largely coincident with that of *nigricornis nigricornis*. Appears adult in mid-July.

OE. NIGRICORNIS NIGRICORNIS F. Walker. Locally abundant in raspberry vines (typical), shrubs and tall herbs in open throughout Pennsylvania. Appears adult in early August. A decidedly atypic condition is very abundant in the high weeds of the marshes along the Delaware River in southeastern Pennsylvania.

OE. PINI Beutenmuller. Arboreal, inhabiting only pine trees in dry sandy areas (Pitch Pine and Scrub Pine, *Pinus rigida*

and *Pinus virginiana*). Possibly present in such areas throughout all but the most boreal portions of Pennsylvania, but the only valid record is Bloomsburg[12]. Northern limits are Gloucester, Massachusetts; Windham, Connecticut; Karner, New York, and Columbiana and Erie Counties, Ohio (E. S. Thomas), while a southern limit is Raleigh, North Carolina. Though rare in collections, individuals are sometimes to be found in large scattered colonies. Appears adult in late July.

OE. LATIPENNIS Riley. Present in the lowlands of southern Pennsylvania; northern limits are the vicinity of Philadelphia and Allegheny County. Occasional in decidious woodlands, on oaks, but also on shrubs and vines. Appears adult in mid-August.

NEOXABEA BIPUNCTATA (DeGeer). Probably absent from the boreal portions of Pennsylvania, this insect should be sought in all other sections. Known from a number of localities in the southeastern area and Jeannette in Allegheny County. Scarce, secretive and very local, often found singly. Prefers vine tangles in openings of woodlands and along forest borders. Appears adult in early August.

TRIGONIDIINAE.

ANAXIPHA EXIGUA (Say). Known north as far as Morrisville and Chestnut Hill in southeastern Pennsylvania, but the species is probably present throughout the lowlands of the State. Local but often moderately abundant when located. Prefers high weeds, grasses and bushes in wet areas and near water. Appears adult in late July.

PHYLLOPALPUS PULCHELLUS Uhler. I have material only from Tinicum Island and the species may be limited to southeastern Pennsylvania. It is decidedly scarce there and very local, in high weedy growth along ditch borders in Delaware River marshes. Appears adult in late July (July 25, 1937, H. R. Roberts).

[12] The atypic condition of *nigricornis nigricornis* discussed above has been incorrectly recorded as *pini* from Delaware County (based on material from Tinicum Island which Rehn and Hebard collected) by Blatchley in 1920.

ENEOPTERINAE.

HAPITHUS AGITATOR AGITATOR Uhler. Probably limited to southeastern Pennsylvania, where it occurs very locally in moderate numbers in the tall weedy growth of the Delaware River shores and marshes. I have it from Cornwells and Tinicum Island, but it is known up the river as far as Burlington, New Jersey. Should be sought also in shrubbery in damp woodland environment. Appears adult in early August.

OROCHARIS SALTATOR Uhler. Possibly limited to southeastern Pennsylvania. There present but very rarely seen in shrubbery and vines particularly near woodlands. Decidedly a rare species in this State. I have material from Cornwells, Philadelphia and Chestnut Hill. Appears adult early in August.

GRYLLOTALPINAE.

GRYLLOTALPA HEXADACTYLA Perty. Lives in burrows in the moist earth along streams or around ponds. Nocturnal and largely subterranean. Local and rarely seen. Probably occurs throughout Pennsylvania, but known only from a number of localities about Philadelphia and Harrisburg (north to Newport). Present adult from early Spring to late Fall.

TRIDACTYLINAE.

TRIDACTYLUS APICIALIS Say. Probably throughout Pennsylvania except in the most boreal areas but there local, usually very scarce and rarely abundant. Prefers bare sand areas near water where it burrows but is on the surface much of the time. Known only from Harrisburg, V, 24, 1909, (Kirk and Champlain) and New Cumberland, V, 15, 1909, (Fox in litt.). Appears adult in September and so persists through the Winter and the following Spring.

T. MINUTUS Scudder. Present only in the warmer portions of Pennsylvania, Chestnut Hill and Port Treverton (material examined) are northern limits. Extremely local but when found usually in great numbers. Lives on bare sand areas near water. Period of adult appearance the same as for *apicialis*.

(To be continued.)

Two Unusual Collecting Records for Pennsylvania (Coleoptera: Scarabaeidae).

On November 6, 1937, while gunning in an open woods near Broomall in Delaware County, I found a nest of a white-footed mouse, beneath a piece of tin on the ground. In scratching around in the nest I found one specimen of *Aphodius leptotarsis Br.* To my knowledge the group of *Aphodius* (Platyderides Br.) to which this species belongs has heretofor been

strictly western, not being found east of the Mississippi River. Mr. W. J. Brown has kindly examined the specimen for me and writes that this is the only specimen he has seen except the two types, which were found in North West Territories and Riley County, Kansas.

Six specimens of Ochodaeus *musculus* (Say) were taken by the writer on June 19, 1937, in a heavy deciduous forest on the grounds of the Westtown School near West Chester. These specimens were collected along with *Odontaeus liebecki* Wallis by scratching away the surface of the leaf mold. This genus has not been recorded in Pennsylvania before, being southern and western in its distribution.—MARK ROBINSON, 1533 So. 56 St., Philadelphia, Pennsylvania.

The Mating of Ephestia kuehniella Zeller and its Results.[1]

By JOSEPH L. WILLIAMS, University of Pennsylvania and Lincoln University, Pennsylvania.

(Plates II and III.)

INTRODUCTION.

The contents of this paper grew out of a desire to verify, in other Lepidoptera, Arnold Pictet's observations of double copulation in *Lasiocampa quercus*. The following is a translated quotation from his observations: Normally the *Lasiocampa quercus* male copulates two successive times with the same female, once by placing himself on her left, then, after being detached from her and after being slightly distant from her for about twenty minutes, a second time by placing himself on her right. In both cases, the penetration of the penis was verified.

His conclusions are as follows:

(1). Only copulation on the left has the power of fertilizing.

(2). Copulation on the right has no other purpose except causing the laying of the eggs fertilized by the union on the left.

(3). The beginning of the laying immediately follows the union on the right. When this has been experimentally suppressed by the removal of the male, the female waits five or six

[1] A Thesis in Zoology presented to the Faculty of the Graduate School of the University of Pennsylvania in partial fulfillment of the requirements for the degree of Master of Arts.

days before beginning the act of laying; however, the eggs are fertilized.

(4). A male which has fertilized a first female can copulate with a second, but no longer has the power of fertilizing her, because he copulates with the second only on the right, and because only the union on the left has the power of fertilizing. The female lays immediately, but her eggs, it is agreed, are not fertilized.

(5). In the case where a second virgin male comes to pair with a female having already received a visit of a first male, during the interruption of egg laying, it is demonstrated that in spite of his virginity, this second male does not fertilize the mass of eggs remaining to be deposited because he only causes the emitting of the eggs fertilized by the first male. Moreover, in this case, the second male does not unite on the left, (coitus through which fertilization took place by the first), but only the right, (coitus which forces the laying). The habit of the species being to practise coitus twice, he copulates a second time, again on the right, which has for the purpose of forcing a third supplementary laying which is not fertilized.

(6). An anatomical study of the constitution of the female reproductive organs makes it obvious that the first coitus, on the left, (fertilization), would be made by the vaginal orifice which is situated to the left of the end of the abdomen, and that the second coitus, to the right, (acceleration of the egg-laying), would take place through the egg-laying orifice, situated on the right on the preceding, and whose sphincter it would dilate. In the case where the union to the right did not take place, (the beginning of the egg-laying being retarded), it is the time of waiting which, because of muscular relaxation, seems to take the place of the effect of the second coitus.

I observed sulphur butterflies in the field but was unable to see the details of the copulatory act. I caged a number of them but they did not copulate in captivity. I raised cabbage butterflies from larvae, but for some reason that particular group did not copulate.

One morning while out in the field I came upon a male and female *Telea polyphemus* lying on the ground together. The penis, at the time I came upon them, was thrust into the bursal opening of the female. I carefully caged the pair and later they broke apart. I brought them home to see if they would copulate again, but no further copulation took place. Later that night, I separated the male from the female and found the

next morning a great number of eggs in the female's cage. I placed the male back with the female but they did not copulate. Later that afternoon, the male died.

The second night, the female laid the greatest number of her eggs; and on the third night she laid a few. By this time, the abdomen which was at first enlarged, had become more slender than the thorax. The eggs were stuck neatly to the wire cage and two days after her last laying she died. Every egg hatched and I was able to raise twenty-six pupae out of this lot, by feeding the larvae on red oak leaves. Although I did not observe these moths from the beginning of copulation, the presence of the penis in the bursal opening suggests a fertilization copulation. Therefore *polyphemus* female does not need a separate copulation to make her lay. Since the first laying took place late that night, hours after I captured the moths, it would seem that waiting was the necessary stimulus for the dilation of the vaginal sphincter.

Later, in the summer of 1936, I took a genetics course, at the University of Pennsylvania under Dr. P. W. Whiting. He uses the wasp, *Habrobracon juglandis,* which is parasitic upon the larva of the moth *Ephestia kuehniella* Zeller. Whenever I would go to the stock boxes to get caterpillars, I would see moths fastened together. I began to study them, since there was a wealth of material available. I have observed hundreds of these moths copulating, and the penis was always found in the bursal opening. The vagina opens into a chitinous ovipositor, but I have never seen the penis in its opening. I have observed females lay fertilized eggs after a copulation only in the bursal opening, and females to lay with dead males hanging to them. Whenever the dead male was fastened to a female, the penis was in the opening of the bursa. I have seen dead females fastened to males and the penis was in the opening of the bursa. I have observed virgin females to lay unfertilized eggs, although the number was small. These observations suggest that the purpose of the bursal copulation is fertilization of the female and cause her to lay a great number of eggs; however, she can lay without copulating with the male, but the number of eggs laid is small.

I dissected a great number of these moths, (more than three hundred), and it was from my dissections that I learned the nature of some of the female organs before and after copulation.

MATING.

When a female is ready to mate, she lies quietly with her abdomen curved upward. The wings are spread apart a little and she keeps this position until mating occurs. If she be disturbed, she will crawl around just as any other female that is not ready to mate. Soon she becomes quiet again, spreads the wings and curves the abdomen upward, waiting for a male.

After mating the female lies quietly for a while, after which she begins to lay her eggs. Active egg-laying continues for about a day, after which she lies quietly, curves her abdomen upward with the wings spread, waiting to mate the second time. After this mating she lies quietly for a while as before, then begins to lay her eggs for another day. I have watched females mate three times. They will mate with the same male or any other male that comes to them.

A male that is ready to mate crawls around vibrating the wings. If he meets a female that is ready to mate, he turns the hind end of his abdomen to the hind end of the female's abdomen, and with the aid of his claspers, the penis is thrust into the bursal opening. The mating period varies from three to five hours. I have seen exceptional cases where the pair stayed together for more than twelve hours. Sometimes the pair is unable to break apart. In such cases the female lays her eggs with the male hanging to her. Under such conditions, one of the pair lives and the other dies. If the female lives, she is, of course, unable to mate with another male. On the average, males do not mate more than twice and after this they die. They live longer if they do not mate. I have been able to keep these moths alive for more than ten days by feeding them sugar or honey water; but their vitality seems to lessen with age. I have tried mating old males that had previously mated with females seeking to mate, but had very little success; greater success was obtained when young males were used.

(To be continued.)

Descriptions of New Melanic Forms (Lepidoptera: Geometridae, Noctuidae and Arctiidae).

By J. G. FRANCLEMONT, Ithaca, New York.

During the past three or four years of collecting numerous melanic forms of various species of moths have been caught, and since some of them have proved to be new, it seems fitting at this time to describe them. I believe that I am justified in doing so on three counts: the moths are very distinct in coloration, melanism is an inheritable characteristic, and numerous people before me have described similar forms of other species —some thinking they represented good species and others realizing that they were merely forms.

GEOMETRIDAE.

VENUSIA COMPTARIA form. nov. **palumbes.**

The fore and hind wings a uniform dark pearly gray, crossed by a blackish median line, all other lines obsolete, a few white streaks on the veins. especially the cubital and anal veins. Thorax and abdomen darker than the wings.

Holytype: ♀, Ithaca, NEW YORK, May 8, 1936 (J. G. Franclemont), [in Coll. Franclemont].

The uniformity in color will serve to distinguish this dark form from the normal form which is very pale and contrastily marked.

PHIGALIA TITEA form. nov. **deplorans.**

The fore and hind wings a uniform powdery black, the fore wings with the post-medial, median and antemedial lines faintly discernible, the subterminal line white but quite faint; the hind wings with a very faint postmedial line, not evident in some specimens. The thorax concolorous with the wings; abdomen darker contrasting with the wings and thorax.

Holytype: ♂, Ithaca, NEW YORK, April 26, 1935 (J. G. Franclemont), [in Coll. Franclemont]. *Paratypes:* 3♂♂, Ithaca, N. Y., April 27, 1935, May 1, 1937, March 22, 1938, (J. G. Franclemont), [in Coll. Franclemont].

This form may be readily distinguished from the typical form by its powdery black coloring and almost obsolete lines, the coloring of the normal form being pale whitish gray with very conspicuous black lines.

VITRINELLA PAMPINARIA form. nov. **stygia.**

The fore and hind wings deep grayish black, the ante- and postmedial lines black, but not conspicuous, a dark median shade on the fore wings, both fore and hind wings with a white subterminal line. The thorax and abdomen concolorous with the wings.

Holytype: ♂, Ithaca, NEW YORK, Aug. 13, 1937 (J. G. Franclemont), [in Coll. Franclemont].

This form differs from the normal form in its almost uniform black color, that of the normal being gray.

NOCTUIDAE.

CATOCALA CEROGAMA form. nov. **ruperti.**

Head black with the bases of the antennae white; thorax black with the collar and tegulae edged with white, the posterior tuft white, the legs with the femora, tibiae and tarsi black on their outer side and white on their inner side. Fore wings shining black with a slight brownish cast in some lights, the subterminal line white, the most conspicuous feature of the fore wings, the postmedial line evident, of intenser black, edged on the outer side by a pale shade, antemedial line indistinct, subreniform pale contrasting with the ground color, reniform very faintly indicated, the fringe black. Hind wings black, paler at base, crossed by a single median yellow band, somewhat reduced compared with that of normal *cerogama*, especially the last third which tends to become obsolete in some specimens, the fringe white. Underside of fore wings black crossed by cream colored postmedial and antemedial bands, underside of hind wings black with the median band and base cream colored tinted with yellow.

Holotype: ♂, Ithaca, NEW YORK, Aug. 20, 1937 (J. G. Franclemont), [in Coll. Franclemont]. *Allotype:* ♀, Ithaca, N. Y., Aug. 16, 1937 (J. G. Franclemont), [in Coll. Franclemont]. *Paratypes:* 16 ♂, 21 ♀, Ithaca, N. Y., July 4 to Sept. 12, 1935 to 1937, (J. G. Franclemont, H. I. Scudder), [in Coll. Franclemont, Lemmer, Rupert and Cornell Univ.]. 4 ♂, 1 ♀; Sardinia, N. Y., Aug. 18 to 30, 1937 (L. R. Rupert), [in Coll. Rupert].

This very conspicuous form can be readily separated from the normal form of *cerogama* by its totally black forewings and by the usual reduction of the yellow band of the hind wings.

I consider this form the showiest *Catocala* we have about

Ithaca, and I look on its gradual increase from year to year with interest. I take great pleasure in naming this form for my friend, Mr. Laurence R. Rupert, who shared with me the pleasure of catching the first specimens.

CATOCALA MESKEI form. nov. **krombeini.**

Head black, bases of the antennae white; thorax black dusted with white, tegulae whitish in central portion, appearing as if margined with black; abdomen grayish brown with a blackish cast. Fore wings powdery black, the margin pale with the veins black in this area, subterminal line white, very conspicuous the postmedial line traceable towards the costal margin, other lines obsolete, the subreniform pale connecting with a whitish patch before the reniform which is barely evident, fringe pale; hindwings as in normal *meskei*. Underside of fore wings black, base pale, and antemedial triangular patch of white and a postmedial band of white narrowing toward inner margin; underside of hindwings flushed with red, a black medium band and a broad black marginal band, fringe white.

Holotype: ♀, Ithaca, NEW YORK, July 23, 1937 (J. G. Franclemont), [in Coll. Franclemont]. *Allotype:* ♂, Ithaca, N. Y., Aug. 5, 1937 (J. G. Franclemont), [in Coll. Franclemont.] *Paratypes:* All Ithaca, N. Y., 1 ♀, July 19, 1937, 1 ♀, July 23, 1937, 1 ♀, July 31, 1937 (J. G. Franclemont), [all in Coll. Franclemont].

Typical *C. meskei* is not considered a common species and it was a surprise to find it at Ithaca this past summer, but more of a surprise was the melanic form. At first I thought it might be nothing more than aberrant *C. briseis*. It differs from typical *meskei* in the black fore wings and may be distinguished from *briseis* by the narrower and more pointed fore wings and the lack of the buff shade between the white subterminal line and the black postmedial line.

This form is named for my friend Mr. Karl V. Krombein, the companion on many collecting excursions.

CATOCALA PARTA form. nov. **forbesi.**

Head and palpi black, bases of the antennae white; thorax brownish gray with the collar and tegulae edged with black; abdomen brownish black. Fore wings intense black with a few brownish shades, subterminal line white, postmedial line intenser black, made evident by a pale shade on its outer side, white at inner margin, antemedial line blackish buff, white at

inner margin, subreniform pale with a black center, reniform traceable, fringe pale; hind wings as in normal *parta*, fringe white; underside of forewings black, with the base white and the two cross bands white; underside of hind wings flushed with red, crossed by a median black band and a wide, black, marginal band.

Holotype: ♀, Sardinia, NEW YORK, Aug. 7, 1934 (J. G. Franclemont), [in Coll. Franclemont]. *Allotype:* ♂, Sardinia, N. Y., Aug. 28, 1937 (L. R. Rupert), [in Coll. Franclemont]. *Paratypes:* Sardinia, N. Y., 1 ♂, July 30, 1934, 1 ♀, Aug. 27, 1937 (L. R. Rupert), [in Coll. Rupert].

This very striking form may be distinguished from the normal form of *parta*, which is soft gray with a few brownish tints, by the almost uniform black coloring of the forewing; the black transverse streak running from the upper angle of the fore wing to the base, so conspicuous in normal *parta*, is completely obscured by the black ground color in this form.

I take pleasure in naming this form for Dr. W. T. M. Forbes, who has done much to "aid and abet" my interest in the Lepidoptera.

CATOCALA NEOGAMA form. nov. **mildredae.**

Head whitish gray, bases of the antennae black, thorax whitish gray, collar and tegulae edged with black, posterior tuft white; abdomen brownish black. Fore wings shining black with bluish or greenish reflections in some lights, brownish shades before the intense black postmedial line, antemedial line intense black becoming white at inner margin, subreniform pale, reniform warm brown, fringe dark; hind wings predominately black, the remaining yellow confined to two spots in the middle of the wings, one on the inner side and the other on the outer side of the median black band; the amount of yellow on the hind wings no doubt will vary with the individual specimens as it does in *cerogama;* fringe buff. Underside of fore wings black, yellow at base and crossed by antemedial and postmedial yellow bands; underside of hind wings black, base yellow and crossed by a yellow median band.

Holotype: ♀, Ithaca, NEW YORK, Aug. 25, 1937 (J. G. Franclemont), [in Coll. Franclemont].

This very handsome moth is a great contrast to the somber colored normal form of *neogama;* its black forewing with the glowing reflections of green and blue will serve to differentiate

it immediately from the normal form with its gray forewings. The amount of black on the hind wings, as noted in the above description, will probably vary from specimen to specimen.

I am pleased to name this beautiful form for my Mother.

ACRONICTA VINNULA form. nov. **percolens.**

Forewings deep olive green, black lines and dashes as in normal *vinnula,* the black postmedial line followed by a series of white lunules, a conspicuous feature of the wing; hind wings blackish gray. Thorax concolorous with the wings, collar and tegulae tipped with white; abdomen smoky gray.

Holotype: ♂, Ithaca, NEW YORK, July 5, 1937 (J. G. Franclemont), [in Coll. Franclemont]. *Allotype:* ♀ Ithaca, N. Y., June 7, 1936 (J. G. Franclemont), [in Coll. Franclemont]. *Paratypes:* All Ithaca, N. Y., 1 ♂, June 2, 1933, 1 ♂, Aug. 5, 1937, 3 ♀, June 7, and Aug. 18, 1937 (J. G. Franclemont), [in Coll. Franclemont].

This pretty little form may be easily recognized by its intense olive color in comparison with the pale whitish gray color of the normal form.

ACRONICTA FRAGILIS form. nov. **atrior.**

Fore wings intense black with a white postmedial line, most noticeable in the females, the males tend to have almost uniform black forewings; hind wings dusky with a darker border. Thorax black; abdomen smoky gray with the basal tuft black.

Holotype: ♂, Ithaca, NEW YORK, May 25, 1936 (J. G. Franclemont), [in Coll. Franclemont]. *Allotype:* ♀, Ithaca, N. Y., June 3, 1936 (J. G. Franclemont), [in Coll. Franclemont]. *Paratypes:* All Ithaca, N. Y. 1936, 1 ♂ 1 ♀, June 9, 1 ♂, June 12, (J. G. Franclemont), [in Coll. Franclemont].

The intense black forewings of this form distinguish it from the normal gray form of the species. This black form is much commoner than the normal form at Ithaca.

ACRONICTA SUPERANS form. nov. **superba.**

Fore wings blackish gray, with deep black shades and ordinary lines visible, the two whitish areas so conspicuous in normal *superans* reduced to dusky blackish shaded areas; hind wings blackish gray, paler at bases. Thorax yellowish gray dusted with black, collar edged with black, tegulae black with a few whitish flecks.

Holotype: ♂, Ithaca, N. Y., May 18, 1936 (J. G. Franclemont), [in Coll. Franclemont]. *Allotype:* ♀, Sardinia, N. Y., June 20, 1934 (J. G. Franclemont), [in Coll. Franclemont].

This form has the forewings almost uniform in darkness of color in contrast to the varigated fore wings of the normal form.

ACRONICTA MORULA form. nov. **columboides.**

Fore wings a deep smoky gray, soft and somewhat olive in hue, with brownish shades, the ordinary lines and dashes as in normal *morula,* an indication of a subterminal row of pale dots and the postmedial line followed by a series of pale lunules; hind wings blackish gray. Thorax concolorous with fore wings, central portion brown; abdomen smoky gray.

Holotype: ♂, Chaffee, NEW YORK, May 14, 1934 [Bred], (J. G. Franclemont), [in Coll. Franclemont]. *Allotype:* ♀, Ithaca, N. Y., July 19, 1937 (J. G. Franclemont), [in Coll. Franclemont]. *Paratypes:* all New York, Crystal Lake, Cattaraugus County, 1 ♂, July 19, 1932; Sardinia, 1 ♂, June 20, 1934; Chaffee, 1 ♂, June 23, 1934; Ithaca, ♂, June 3, 1936, 3 ♂, 3 ♀, July 7, to 22, 1937, (J. G. Franclemont), [all in Coll. Franclemont].

This form will be readily recognized by its dark coloring as compared with the pale whitish gray coloring of the normal form.

ACRONICTA DISTANS form. nov. **scintillans.**

Fore wings shining gray black with a slight tendency to appear powdery, a series of subterminal whitish spots, ordinary lines and spots present of intenser black than the ground color; hind wings blackish gray, paler at base, females with hind wings all black. Thorax black contrasting somewhat, but not noticeably with the fore wings; abdomen dark luteous black.

Holotype: ♂, Crystal Lake, Cattaraugus County, NEW YORK, Aug. 2, 1933 (J. G. Franclemont), [in Coll. Franclemont] *Allotype:* ♀, Chaffee, N. Y., Aug. 3. 1934 (J. G. Franclemont), [in Coll. Franclemont] *Paratypes:* Chaffee, N. Y., 2 ♂, July 17, and 31, 1934; Crystal Lake, Catt. Co., N. Y., 1 ♀, July 28, 1933; Ithaca, N. Y., 1 ♂, May 12, 1936, 1 ♀, July 22 and 1 ♂, Aug 5, 1937 (J. G. Franclemont), [in Coll. Franclemont].

The deep shining black color of the fore wings will readily aid in distinguishing this form from the normal gray form. It is not as common as the dark form of *impleta*, but appears to be more widely distributed.

ARCTIIDAE.

HAPLOA CONFUSA form. nov. **suffusca.**

Forewings with the ground color dark fuscous, the ordinary markings of the species not contrasting to any great degree with the ground color, but nevertheless evident because of the relatively darker color; hind wings pale fuscous, lighter at base; thorax fuscous, tegulate white; abdomen dusky with a dark dorsal stripe.

Holotype: ♂, Allegany State Park, NEW YORK, July 16, 1936 (E. Greenspan), [in Coll. Franclemont].

The deep fuscous color of the fore wings will immediately separate this form from the normal form which has the ground color of the primaries white; the lack of strong contrast between ground color and markings is also a distinguishing characteristic when compared with the normal form which has the black markings in sharp contrast with the white ground color.

A South African Onthophagus Found in United States (Coleoptera: Scarabaeidae)*

Specimens of an unusual Onthophagus collected by Professor P. W. Fattig near Vidalia and Lyons, Georgia, have been determined as *Onthophagus depressus* Har., a South African species, by Dr. G. J. Arrow of the British Museum. Dr. Arrow, in commenting upon the species states that the same species has been described from Australia under the name *Onthophagus carteri* by Blackburn. Professor Fattig first collected the species at light at Vidalia, Georgia, May 4, 1937. A few more were found August 11 and on August 30, 1937 about three hundred specimens were taken in cow dung at two localities,—three miles southwest of Vidalia and two and one-half miles west of Lyons. These localities are about seventy-five miles inland west of Savannah, Georgia. How and when this African species was introduced into the United States is unknown at present.

* Technical Contribution No. 57 from South Carolina Experiment Station.

O. depressus Har., is uniformly black, broadly oval, evenly convex, 6 to 9 mm., in length, 3 to 5 mm., in width, and shows only slight sexual differences. Clypeus with two teeth as in *Canthon laevis*. Surface of head and clypeus with close transversely elongate granules. Thorax closely coarsely annularly punctate, each puncture bearing a very short coarse yellowish hair and having a more or less noticeable granule immediately in front of the hair. Elytral punctures similar but in rows, those of the fine shallow striae similarly annular but without the hair and granule. In size and color, *O. depressus* Har., is nearest our common *O. hecate* Panz.—O. L. CARTWRIGHT, South Carolina Experiment Station, Clemson, South Carolina.

Some Interesting Butterfly Records for South Florida.

The following records of butterflies taken in or around Miami, Florida, seem to be new or of some interest:

Anteos maerula maerula (Fabricus). A single damaged specimen of this tropical American species was taken by the author on July 8, 1935. Another specimen taken at Miami is in the possession of Mrs. C. N. Grimshawe. It is apparently only an occasional immigrant from the Antilles to judge from the badly beaten condition of the specimens I have seen.

Kricogonia lyside (Godart). Several specimens of this rather rare species were taken by the author during June, 1937. The first specimen was taken at Miami, June 13, 1937, and about a dozen others were taken on Virginia Key in Biscayne Bay between June 15 and 17. The latter specimens were all taken feeding on the flowers of black mangrove trees along the beach. From the fresh condition of most of the specimens, I should say that the species breeds in Florida.

Hypolimnas misippus (Linneus). A male of this butterfly was taken during April, 1934, in a grove at Miami. This insect seems to have been very infrequently taken in the New World.

The specimens mentioned above, with the exception of the specimen taken by Mrs. Grimshawe, are now in the collection of the Museum of Comparative Zoology, Harvard College.—FRANK N. YOUNG, Department of Biology, University of Florida.

Current Entomological Literature

COMPILED BY V. S. L. PATE, LAURA S. MACKEY and E. T. CRESSON, Jr.

Under the above head it is intended to note papers received at the Academy of Natural Sciences, of Philadelphia, pertaining to the Entomology of the Americas (North and South), including Arachnida and Myriopoda. Articles irrelevant to American entomology will not be noted; but contributions to anatomy, physiology and embryology of insects, however, whether relating to American or exotic species will be recorded.

This list gives references of the current or last year unless otherwise noted. All continued papers, with few exceptions, are recorded only at their first installment.

For records of Economic Literature, see the Experiment Station Record, Office of Experiment Stations, Washington. Also Review of Applied Entomology, Series A, London. For records of papers on Medical Entomology, see Review of Applied Entomology, Series B.

Note. References to papers containing new forms or names not so stated in titles are followed by (*); if containing keys are followed by (k); papers pertaining exclusively to neotropical species, and not so indicated in the title, have the symbol (S) at the end of the title of the paper.

The figures within brackets [ ] refer to the journal in which the paper appeared, as numbered in the list of Periodicals and Serials published in our January and June issues. This list may be secured from the publisher of Entomological News for 10c. The number of, or annual volume, and in some cases the part, heft, &c., the latter within ( ) follows; then the pagination follows the colon :

Papers published in the Entomological News are not listed.

GENERAL.—Dymond, J. R.—External parasites of bats. [4] 70: 20-21. **Knaus, Warren.**—Obituary by G. A. Dean. [103] 11: 1-3. **Weiss, H. B.**—The criminal prosecution of insects. [6] 45: 241-258.

ANATOMY, PHYSIOLOGY, ETC.—Asana & Makino.—The occurrence of v-shaped centrioles in the spermatocytes of some Neuropteran insects. [Ann. Zool. Japonenses] 16: 175-180, ill. **Beadle, Anderson & Maxwell.**—A comparison of the diffusible substances concerned with eye color in Drosophila, Ephestia and Habrobracon. [Proc. Nat. Acad. Sci.] 24: 80-85. **Dreyer, W. A.**—Seasonal weight and total water content of the mound-building ant, Formica exsectoides. [84] 19: 38-49. **DuBois, A. M.**—La determination de l'ebauche embryonnaire chez Sialis lutaria. [Rev. Suisse Zool.] 45: 1-92, ill. **Freney, M. R.**—Studies on the chemotropic behaviour of sheep blowflies. [Comm. Australia Counc. Sci. & Ind. Res.] Pamph. No. 74: 24pp., ill. **Goldschmidt, R.**—see under Special. **Grell, K. G.**—Der Darmtraktus von Panorpa communis und seine Anhange bei Larve und Imago. (Ein Beitrag zur Anatomie und Histologie der Mecopteren). [89] Abt. Anat.; 64: 1-86, ill. **Harries, F. H.**—Some effects of temperature on the development and oviposition of Microbracon hebetor. [43] 37: 165-171. **Hoffmann, R. W.**—Der insektenschlaf als reflektorische immobilisation. [88] 25: 359-366, ill. **Hood, C. W.**—The anatomy of the digestive system of

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SPECIAL NOTICES.—Goldschmidt, R.—Physiological Genetics. McGraw-Hill Book Co., N. Y., 1938, viii + 375 pp., ill. **Theobald, N.**—Les insectes fossiles des terrains oligocenes de France. Nancy, G. Thomas, 1937. 437 pp., 29 pls. **Vogelsanger, Th.**—Aus dem entomologischen Tagebuch von Dr. Med. F. Ris. [Mitteilungen der Naturforschenden Gesellschaft Schaffhausen] 13 (7): 159-203. This first installment concerns Lepidoptera almost exclusively.

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